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GEORGIA COASTAL PLAIN GEOLOGY AND PHYSIOGRAPHY*

The study of coastal plain geology involves peculiar difficulties. The Triassic and older rocks, in the eastern United States, can be traced over large areas by lithological characters alone; but in the coastal plain, whose strata are all Cretaceous and later, and mostly not indurated, formations of very different age often look strikingly alike and, more perplexing still, the same formation often varies greatly in appearance in comparatively short distances, especially where it has been subjected to weathering. It is usually important, in order to be sure of the identity of a given coastal plain formation, to have fossils; and outcrops of fossiliferous rock in that region are few and far between, because the coastal plain, as its name implies, has been comparatively little dissected by erosion, and rocky bluffs are chiefly confined to the banks of the larger streams. The interstream areas are mostly covered either with residual soil or with non-fossiliferous superficial formations, which are of no use to the paleontologist.

The usual method of mapping coastal plain geology is to locate the outcrops of each formation on the rivers and connect these by lines, making allowance for the dip of the strata and the elevation of the interstream areas, and taking advantage of any recognizable fossiliferous exposures that may be discovered on the uplands. Where river-bank exposures are rare or absent, the paleontological geologist is often ''at sea''; but one who has had sufficient experience with the geography of the coastal plain can often tell a great deal about the geology by noting the topography, soil and vegetation.[1]

In our coastal plain the relations between geology, on the one hand, and topography, soil and vegetation, on the other, seem to be most clearly exhibited in Mississippi and Alabama, about on a line with the axis of the Appalachian uplift, where the region reaches its greatest elevation, about 1,000 feet above sea-level, with an average elevation over large areas of about half that amount. Largely on account of this elevation, and the length of time that this part of the coastal plain has been exposed to erosion, the land surface has been somewhat deeply sculptured, and differences in texture and composition of the strata of different ages are fairly well reflected in the topography. Going eastward on the coastal plain, however, the elevation gradually decreases, until in Virginia tide-water reaches inland to the margin of the crystalline rocks, and the whole plain appears well-nigh featureless to one who knows it best in the eastern Gulf States.

The great topographic and floristic diversity of the coastal plain in Mississippi was taken advantage of, more than a half century ago, by Dr. E. W. Hilgard in mapping the geology of the state in his monumental ''Geology and

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* Preliminary Report on the Geology of the Coastal Plain of Georgia. By Otto Veatch and Lloyd William Stephenson. *Geol. Surv. of Georgia, Bull. 26.* 466 pp. Maps, ills. Atlanta [1912].

[1] Scarcely a hint of any such methods of research is to be found in our geological textbooks; but some valuable suggestions may be gleaned from the writings of D. D. Owen, E. W. Hilgard, E. A. Smith, A. Hollick, R. T. Hill, and a few other geologists knowing something of botany.

Agriculture of Mississippi,'' published in 1860 and, in many respects, not yet surpassed. In Alabama, Dr. Eugene A. Smith, a younger colleague of Dr. Hilgard, after publishing several preliminary papers on the subject, issued from the office of the Geological Survey of Alabama, in 1894, a voluminous report on the geology of the coastal plain, and a large colored geological map of the state, which is still much sought after, though the edition was soon exhausted.[2]

For Florida, Georgia, the Carolinas and Virginia there have been many short papers, but no comprehensive account, until very recently, of the coastal plain geology of either state. To expedite the progress of our knowledge of the geology of these parts of the country, the U. S. Geological Survey, a few years ago, arranged to coöperate with several of the state surveys in prosecuting the work. As a result of this coöperation, a report on the geology of Florida, by three government geologists, was published by the newly-organized state survey in 1909,[3] the one here noticed early in 1912, and one for the coastal plain of Virginia,[4] by three Maryland geologists, about the same time. A similar report on eastern North Carolina[5] appeared in the summer of 1913.

The present work is not the first attempt to describe the geology of the coastal plain of Georgia, as its title would seem to imply, but it contains more information about the geology, and incidentally the topography, of that region than had been brought together in a single volume before. Naturally the map accompanying it is equally noteworthy. With the exception of the large geological map of North America published by the U. S. Geological Survey a few weeks earlier, this is the first strictly geological map which shows the inland edge of the Altamaha formation in Georgia anywhere near correctly. A map of the same formation, identified mainly by its topography and vegetation, was published by the reviewer in botanical papers in 1906[6] and 1907; but a geological map of Georgia published by the State Survey in 1908, 1909 and 1910[7] combined this formation with several others, thus obscuring its boundaries.

The base-map on which the geology is printed in colors is a government post-route map of Georgia about five years old, with nearly all the mail-routes other than railroads eliminated, and the whole reduced to a scale of 1:1,000,000. Georgia, being the largest and latest of the original thirteen states, has never been so accurately surveyed as some of the older and more thickly-settled states, or as the newer states farther west which were surveyed long ago by the township system. Consequently there is no base map of Georgia as yet which does not show errors easily detected by the eye, without any measurement. The post-route map, while remarkably accurate in some respects, even outside of the area covered by the topographic maps of the U. S. Geological Survey, is remarkably inaccurate in others, such as in the location of some of the railroads. Probably the most serious error consists in placing the largest pond in the state (Ocean Pond, Lowndes County) several miles northwest of its true position, and making it much too large.

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[2] Geological Map of Alabama, with explanatory chart. Geological Survey of Alabama, Eugene A. Smith, State Geologist, Montgomery, Ala., 1894.

[3] A Preliminary Report on the Geology of Florida with special reference to the stratigraphy. By George C. Matson and F. G. Clapp. Prepared in cooperation between the U. S. Geological Survey and the Florida State Geological Survey under the direction of Thomas W. Vaughan. Maps, ills. *Florida Geol. Surv. 2nd Ann. Rept., 1908–09*, pp. 21–299. Tallahassee, 1909.

[4] The Physiography and Geology of the Coastal Plain Province of Virginia. By W B. Clark and B. L. Miller. With chapters on the Lower Cretaceous by E. W. Berry and Economic Geology by T. L. Watson. Maps, index. *Virginia Geol. Surv. Bull. No. 4*, pp. 13–222. Charlottesville, 1912.

[5] The Coastal Plain of North Carolina. By W. B. Clark, B. L. Miller and others. 552 pp. Maps, ills., index. *North Car. Geol. and Econ. Surv.*, Vol. 3, 1912.

[6] *Ann. N. Y. Acad. Sci.*, Vol. 17, frontispiece.

[7] In *Bulletins 15, 18 and 23.*

In the spelling of certain geographical names, such as Ochlocknee, Okefinokee, Suwannee, and Purysburg, the authors have followed non-resident rather than local usage. And in nearly every case where a particular river is mentioned the word ''the'' before the name is omitted; this does not conform with spoken usage, and seems to have almost no precedent outside the publications of the U. S. Geological Survey.

The illustrations are not confined to purely geological subjects and some of them would be perfectly appropriate in a botanical report. Nearly all are new; but some were taken in Alabama and Florida, and one of the latter (plate 2A) was published two years before as plate 6, Fig. 2, of the second *Annual Report* of the Florida Geological Survey. None of them are dated.[8]

The most interesting part of the report, to geographers and geomorphologists, will be Veatch's chapter (pp. 25-57) on physiography. Six divisions of the coastal plain are recognized (and mapped in outline on page 28): Fall-line Hills, Dougherty Plain, Altamaha Upland, ''southern lime-sink region,'' Okefinokee Plain, and Satilla Plain. Some of these, especially the first, are entirely too heterogeneous, and a somewhat larger number would have been better for geographical purposes. Ten divisions of the same area were described, and eight of them mapped, by the reviewer in 1906.[9] The ''southern lime-sink region'' is represented as being in contact with the Dougherty Plain for about thirty miles, which is an error, for they are really completely separated by several miles of the Altamaha Upland, which is a very conspicuous feature in the southwestern corner of the state and adjacent Florida. The geological map is more accurate in this respect. Placing the Fall-line Hills and Altamaha Upland in juxtaposition from near Sandersville to the Savannah River is also questionable.

One of the most remarkable topographic features of the flatter parts of the coastal plain, a low ridge skirting the east side of Okefinokee Swamp and extending parallel with the coast for over 100 miles in Georgia and Florida (known in Florida as Trail Ridge), is dismissed in a few words. It has never yet been explained by the geologists of either state. It is much more conspicuous, though, than the lower ridge to the eastward which has been taken by Veatch for the boundary between his two easternmost plains.[10] The ''Slough'' of Mitchell County, though shown on the map, is ignored entirely in the text, and that too has never been explained, or even mentioned in geological literature.[11] Other unexplained topographic features are the sand hills on the left banks of creeks and rivers (discussed on pages 449-450, 454-456) and the islands along the coast. Some of the interpretations of other topographic features seem open to question.

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[8] There is much to be said in favor of dating photographs. The date of a photograph ought to be as important as that of a botanical or zoölogical specimen.

[9] *Ann. N. Y. Acad. Sci,*, Vol. 17, pp 13-20.

[10] For notes on these ridges see *Pop. Sci. Monthly*, Vol. 74, 1909, pp. 601-604; also *Annual Rep. Florida Geol. Surv.*, Vol. 3, 1911, p. 225; and *Bull. Torrey Botanical Club*, Vol. 38, 1911, p. 230.

[11] *Bull. Torrey Bot. Club*, Vol. 30, 1903, pp. 288-289.

Most of the purely geological portions of the text appear to be above criticism. As usual in recent publications of this character, the authors have proposed several new formation names.

Doubtless as a result of the modern tendency to specialization in education, the authors do not seem to have a working knowledge of botany, and thus an important aid to their geological studies has been lacking. Neither have they (nor any one else in that region, apparently) utilized to the utmost the possibilities of interpreting geology by means of topography in regions where fossils are lacking, as suggested above.

Most of the important previous geological papers on the region are mentioned in the text or in footnotes, but the names of authors are not fully indexed. The index fills only ten pages, and there is no bibliography, so that it is not easy for the reader to make sure whether any particular paper has been cited or not. Otherwise the report seems nearly complete, and it will doubtless be a standard reference work for years to come. ROLAND M. HARPER.